

8-03 IRRIGATION SYSTEMS**8-03.1 Description**

This Work consists of installing an irrigation system in accordance with these Specifications and the details shown in the Plans or as staked.

8-03.2 Materials

Materials shall meet the requirements of Sections 9-15 and 9-29.

8-03.3 Construction Requirements

Location of pipe, tubing, sprinkler heads, emitters, valves, and other equipment shall be as shown in the Plans and shall be of the size and type indicated. No changes shall be made except as approved by the Engineer.

Potable water supplies shall be protected against cross connections in accordance with applicable Contracting Agency and Washington State Department of Health rules and regulations. Irrigation systems using a non-potable water source shall have equipment marked with appropriate purple markers as supplied by the equipment manufacturer.

Construction of electrical systems shall conform to applicable portions of Sections 8-20 and 9-29.

8-03.3(1) Layout of Irrigation System

The Contractor shall stake the irrigation system following the schematic design shown in the Plans, before the construction begins for approval by the Engineer. Alterations and changes in the layout may be expected in order to conform to ground conditions and to obtain full and adequate coverage of plant material with water; however, no changes in the system as planned shall be made without the prior authorization of the Engineer.

Irrigation Potholing

Existing underground irrigation sleeve ends shall be located by potholing.

8-03.3(2) Excavation

Pipe trenches shall be no wider at any point than is necessary to lay the pipe or install equipment. The top 6-inches of topsoil, when such exists, shall be kept separate from subsoil and shall be replaced as the top layer when backfill is made. Trench bottoms shall be relatively smooth and consist of sand or other suitable material free from rocks, stones, or any material that might damage the pipe. Trenches in rock or other material unsuitable for trench bottoms shall be excavated 6-inches below the required depth and shall be backfilled to the required depth with sand or other suitable material free from rocks or stones.

The Contractor shall exercise care when excavating trenches near existing trees to minimize damage to tree roots. Where roots are 2-inches and greater in diameter, except in the direct path of the pipe, the pipe trench shall be hand excavated and tunneled. When large roots are exposed, they shall be wrapped with heavy burlap for protection and to prevent excessive drying. Trenches dug by machines adjacent to trees having roots 2-inches and less in diameter shall have the sides hand trimmed making a clean cut of the roots. Trenches having exposed tree roots shall be backfilled within 24-hours unless adequately protected by moist burlap or canvas as approved by the Engineer.

Detectable marking tape shall be placed in the trench 6-inches directly above, parallel to, and along the entire length of all nonmetallic water pipes and all nonmetallic and aluminum sleeves, conduits and casing pipe. The width of the tape shall be as recommended by the manufacturer for the depth of installation.

8-03.3(3) Piping

All lines shall be a minimum of 18-inches below finished grade measured from the bottom of the pipe or as shown in the Plans. All live mains to be constructed under existing pavement shall be placed in steel casing jacked under pavement as shown in the Plans. All PVC pipe installed under areas to be paved shall be placed in irrigation conduit. Irrigation conduit shall extend a minimum of 1-foot beyond the limits of pavement. All jacking operations shall be performed in accordance with an approved jacking plan. Where possible, mains and laterals or section piping shall be placed in the same trench. All lines shall be placed a minimum of 3-feet from the edge of concrete sidewalks, curbs, guardrail, walls, fences, or traffic barriers.

Mainlines and lateral lines shall be defined as follows:

Mainlines: All supply pipe and fittings between the water meter and the irrigation control valves.

Lateral Lines: All supply pipe and fittings between the irrigation control valves and the connections to the irrigation heads. Swing joints, thick walled poly pipe, flexible risers, rigid pipe risers, and associated fittings are not considered part of the lateral line but incidental components of the irrigation heads.

Pipe pulling will not be allowed for installation and placement of irrigation pipe.

8-03.3(4) Jointing

During construction, pipe ends shall be plugged or capped to prevent entry of dirt, rocks, or other debris.

All galvanized steel pipe shall have sound, clean cut, standard pipe threads well fitted. All pipes shall be reamed to the full diameter and burrs removed before assembly. Threaded galvanized steel joints shall be constructed using either a nonhardening, nonseizing multipurpose sealant or Teflon tape or paste as recommended by the pipe manufacturer. All threaded joints shall be made tight with wrenches without the use of handle extensions. Joints that leak shall be cleaned and remade with new material. Caulking or thread cement to make joints tight will not be permitted.

PVC pipe, couplings, and fittings shall be handled and installed in accordance with the manufacturer's recommendation. The outside of the PVC pipe shall be chamfered to a minimum of 1/16-inch at approximately 22-degrees. Pipe and fittings shall be joined by solvent welding. Solvents used must penetrate the surface of both pipe and fitting which will result in complete fusion at the joint. Use solvent and cement only as recommended by the pipe manufacturer.

Threaded PVC joints shall be assembled using Teflon tape as recommended by the pipe manufacturer.

On plastic to metal connections, work the metal connection first. Use a nonhardening compound on threaded connections. Connections between metal and plastic are to be threaded utilizing female threaded PVC adapters with threaded schedule 80-PVC nipple only.

Polyethylene pipe and fittings shall be installed in accordance with the manufacturer's recommendations. The ends of the polyethylene pipe shall be cut square and inserted to the full depth of the fitting. Clamps for insert fittings shall be stainless steel.

8-03.3(5) Installation

Galvanized pipe shall be used from the water meter or service connection through the cross connection control device.

Final position of turf heads shall be between ½-inch and 1-inch above finished grade measured from the top of the sprinkler. All sprinklers adjacent to walks, curbs, and pavement shall be placed as shown in the Plans.

Shrub heads, unless otherwise specified, shall be placed on risers approximately 12-inches above finished grade.

Final position of valve boxes, capped sleeves, and quick coupler valves shall be between ½-inch and 1-inch above finished grade or mulch.

Drip irrigation emitters shall be installed in accordance with the manufacturer's recommendations. Install drain valves at the lowest point of each zone in an 8-inch diameter round valve box over 3 cubic feet of washed gravel.

8-03.3(6) Electrical Wire Installation

Wiring between the automatic controller and automatic valves shall be direct burial and may share a common neutral. Separate control conductors shall be run from the automatic controller to each valve. When more than 1 automatic controller is required, a separate common neutral shall be provided for each controller and the automatic valve which it controls. Wire shall be installed adjacent to or beneath the irrigation pipe. Plastic tape or nylon tie wraps shall be used to bundle wires together at 10-foot intervals, and the wire shall be "snaked" from side to side in the trench. When necessary to run wire separate from the irrigation pipe, the wire shall be bundled and placed under detectable marking tape. When lateral pipelines have less than 18-inches of cover, direct burial wire shall not be adjacent to pipes but shall be placed at a minimum depth of 18-inches.

Wiring placed under pavement and walls, or through walls, shall be placed in irrigation casing. Irrigation casing shall not be less than 1-inch in diameter, Class 200-PVC.

Splices will be permitted only at junction boxes, valve boxes, pole bases, or at control equipment. A minimum of 2-feet of excess conductor shall be left at all splices, terminal and control valves to facilitate inspection and future splicing.

All 120-volt electrical conductors and conduit shall be installed by a certified electrician including all wire splices and wire terminations.

For all 24-volt direct burial circuits, the continuity test, ground test, and functional test shall be performed. The Megger test confirming insulation resistance of not less than 2 megohms to ground in accordance with Section 8-20.3(11) is required.

All wiring shall be tested in accordance with Section 8-20.3(11).

8-03.3(7) Flushing and Testing

All gauges used in the testing of water pressures shall be certified correct by an independent testing laboratory immediately prior to use on the project. Gauges shall be retested when ordered by the Engineer.

Automatic controllers shall be tested by actual operation for a period of 2-weeks under normal operating conditions. Should adjustments be required, the Contractor shall do so according to the manufacturer's direction and test until operation is satisfactory.

Main Line Flushing

All main supply lines shall receive 2 fully open flushings, to remove debris that may have entered the line during construction: the first before placement of valves; the second after placement of valves and prior to testing.

Main Line Testing

All main supply lines shall be purged of air and tested with a minimum static water pressure of 150-psi for 60-minutes without introduction of additional service or pumping pressure. Testing shall be done with 1 pressure gauge installed on the line, where ordered by the Engineer. An additional pressure gauge shall be installed at the pump when ordered by the Engineer. Lines that show loss of pressure exceeding 5-psi at the ends of specified test periods will be rejected.

The Contractor shall correct rejected installations and retest for leaks as specified herein.

Lateral Line Flushing

All lateral lines shall receive 1 fully open flushing prior to placement of sprinkler heads, emitters, and drain valves. The flushing shall be of sufficient duration to remove any dirt or debris that has entered the lateral lines during construction.

Lateral Line Testing

All lateral lines shall be purged of air and tested in place at operating line pressure with a pressure gauge and with all fittings capped or plugged. The operating line pressure shall be maintained for 30-minutes with valves closed and without introduction of additional pressure. Lines that show leaks or loss of pressure exceeding 5-psi at the end of specified test periods will be rejected.

The Contractor shall correct and retest lateral line installations that have been rejected. Throughout the life of the Contract, the Contractor shall repair, flush, and test, all main and lateral lines that have sustained a break or disruption of service. Upon restoration of the water service, the affected lines shall be brought up to operating pressure. The Contractor shall then conduct a thorough inspection of all sprinkler heads, emitters, etc., located downstream of the break, disruption of service, and repair. This inspection is required to ensure that the entire irrigation system is operating properly.

8-03.3(8) Adjusting System

Before final inspection, the Contractor shall adjust and balance all sprinklers to provide adequate and uniform coverage. Spray patterns shall be balanced by adjusting individual sprinkler heads with the adjustment screws or replacing nozzles to produce a uniform pattern. Unless otherwise specified, sprinkler spray patterns will not be permitted on pavement, walks, or Structures.

8-03.3(9) Backfill

Backfill shall not be started until all piping has been inspected, tested, and approved by the Engineer, after which backfilling shall be completed as soon as possible. All backfill material placed within 6-inches of the pipe shall be sand or other suitable material free of rocks, roots, or other objectionable material that might cut or otherwise damage the pipe. Backfill from the bottom of the trench to approximately 6-inches above the pipe shall be by continuous compacting in a manner that will not damage pipe or wiring and shall proceed evenly on both sides of the pipe. The remainder of the backfill shall be thoroughly compacted, except that heavy equipment shall not be used within 18-inches of any pipe. The top 6-inches of the backfill shall be of topsoil material or the first 6-inches of material removed in the excavation.

8-03.3(10) As Built Plans

Upon Physical Completion of the Work, the Contractor shall submit As Built Plans consisting of corrected shop drawings, schematic circuit diagrams, or other details necessary to show the Work as constructed including the actual installed locations of the irrigation system(s) equipment including, but not limited to, water meters, cross connection control devices, electrical services, pipe and wire runs, splice boxes, controllers, valves, heads, and other equipment. These drawings shall be on sheets conforming in size to the provisions of Section 1-05.3. All drawings must be complete and legible.

Any corrections and additions ordered by the Engineer shall be made by the Contractor prior to acceptance. The Contractor shall provide the Engineer with 3 copies of parts lists, catalog cuts, and service manuals for all equipment installed on the project.

8-03.3(11) System Operation

The irrigation system shall be completely installed, tested, and automatically operable prior to planting in a unit area except where otherwise specified in the Plans or approved by the Engineer. The Contractor shall be fully responsible for all maintenance, repair, testing, inspecting, and automatic operation of the entire system until all Work is considered complete as determined by the final inspection specified in Section 1-05.11. The final inspection of the irrigation system will coincide with the end of the Contract or first-year plant establishment whichever is later.

This responsibility shall include, but not be limited to, draining the system prior to winter and reactivating the system in the spring and at other times as ordered by the Engineer.

For the life of the Contract, the Contractor shall be responsible for having annual inspections and tests performed on all cross connection control devices as required and specified by the Washington State Department of Health. Inspections and tests shall be conducted at the time of initial activation and each spring prior to reactivating the irrigation system. Potable water shall not flow through the cross-connection control device to any downstream component until tested and approved for use by the serving utility.

In the spring, when the drip irrigation system is in full operation, the Contractor shall make a full inspection of all emitters. This shall involve visual inspection of each emitter under operating conditions. All adjustments, flushings, or replacements to the system shall be made at this time to ensure the proper operation of all emitters.

8-03.3(12) Cross Connection Control Device Installation

Cross connection control devices shall be installed, inspected, and tested by the serving utility or designee in accordance with applicable portions of the Washington Administrative Code (WAC-246-290-490) and other applicable regulations as set forth by the Washington State Department of Health and the Washington State Department of Transportation.

During the life of the Contract, these devices shall be inspected and tested annually, or more often if successive inspections indicate repeated failures. Inspections and tests shall be conducted at the time of initial installation, after repairs, and each spring prior to reactivation of the irrigation system. These inspections and tests shall be completed and the results recorded by a licensed Backflow Assembly Device Tester (BADT) Operator or by a Contracting Agency Certified Water Works Operator with a CCS 1 or CCS 2 Classification and shall document that the devices are in good operating condition prior to flushing and testing of any downstream water lines. Devices that are defective shall be repaired or replaced.

Inspection and test results shall be recorded on Department of Transportation Form No. DOT 540-020 and other forms as may be required by the serving utility. The completed forms shall be submitted to the appropriate health authority and to the serving utility when applicable.

8-03.3(13) Irrigation Water Service

The Contracting Agency has arranged for a water meter installation(s) for the irrigation system at no cost to the Contractor at the locations and sizes as shown in the Plans. The water meter(s) will be installed by the serving utility. It shall be the Contractor's responsibility to contact the Engineer to schedule the water meter installation performed by the servicing utility. The Contractor shall provide a minimum of 60-calendar days prior notice to the Engineer for the desired date for installation to ensure no service installation delays Work.

Construction activities for irrigation water service connections will be in accordance with the serving utility's Service Agreement. A copy of the Service Agreement may be obtained from the Engineer.

8-03.3(14) Irrigation Electrical Service

The Contracting Agency has arranged for electrical service connection(s) for operation of the automatic electrical controller(s) at the locations as shown in the Plans. The Contractor shall splice and run conduit and wire from the electrical service connection(s), or service cabinet, which ever may apply, to the automatic electrical controller and connect the conductors to the circuit(s) as shown in the Plans.

The installation of conduit and wire for the electrical power service shall be in accordance with the serving utility's Service Agreement and these Specifications. A copy of the Service Agreement may be obtained from the Engineer.

8-03.4 Measurement

No unit of measure shall apply to the lump sum price for irrigation system.

8-03.5 Payment

Payment will be made in accordance with Section 1-04.1, for the following Bid items when included in the Proposal:

“Irrigation System”, lump sum.

All costs for furnishing and installing irrigation system equipment and components where indicated and as detailed in the Plans, all costs of initial and annual inspections and tests performed on cross connection control devices and electrical wire testing during the life of the Contract and As Built Plans shall be included in the lump sum price for the complete irrigation system as shown in the Plans or as otherwise approved by the Engineer.

The Contracting Agency will, at no cost to the Contractor, provide water and electrical services needed for installation and operation of the irrigation system for the life of the Contract.

As the irrigation system is installed, the payment schedule will be as follows:

Payment will be made in proportion to the amount of Work performed up to 90-percent of the unit Contract price for irrigation system when the irrigation system is completed, tested, inspected, and fully operational.

Payment shall be increased to 95-percent of the unit Contract price for irrigation system upon completion and acceptance of initial planting and submittal of As Built Plans.

Payment shall be increased to 100-percent of the unit Contract price for irrigation system upon completion and acceptance of the first-year plant establishment. When there is no first-year plant establishment or when the Contract is completed, payment will be increased to 100-percent of the unit Contract price for irrigation system upon completion of As Built Plans.